

**JYOTI NIVAS COLLEGE AUTONOMOUS  
SYLLABUS FOR 2018 BATCH AND THEREAFTER**

**Programme: B.Sc.**

**Semester: VI**

**GENETICS PAPER VII  
ADVANCED GENETICS**

**Course Code: 18VIGT7**

**No. of Hours: 45**

**COURSE OBJECTIVES:**

- To give students some perspective about how advances in the field of genetics is revolutionizing the study of biological sciences and opening up wider scope for research and career options
- 2. To define and understand statistical measures of heritability and inheritance of polygenic traits
- 3. To understand developmental and behavioural genetics and immunogenetics
- 4. To initiate the students to Project work related to the subject and recorded as a dissertation

**LEARNING OUTCOMES:**

- The students will be able to appreciate the genetics of development in both plants and animals and the genetic effect on behavior.
- Will be able grasp the effect of polygenes on the phenotypic expression of a trait and the effect of quantitative genetics on selection of plants and animals for breeding purposes to improve the trait
- Will be able to appreciate the genetics of immunity and its role in organ transplant
- They developed the skill to design, conduct and write a dissertation on related genetic topics and face a viva-voce that helped them in their further studies

**UNIT – I DEVELOPMENTAL GENETICS 09 HRS**

Basic concepts of embryogeny 01 HRS

Role of nuclear transplantation in development of *Xenopus*, *Acetabularia* 01 HR

Tissue specific DNA methylation in differential gene expression during development Eg. Differential expression of haemoglobin genes 01 HR

Genetics of development in *Drosophila* – early development, maternal genes, segmentation genes; homeotic genes 04 HRS

*Arabidopsis*- Homeotic genes in genetic control of flower morphogenesis 02 HRS

**UNIT – II EVOLUTIONARY AND BEHAVIOURAL GENETICS 11 HRS**

Darwinism, Mutation Theory, Neo Darwinism 02 HRS

Hardy-Weinberg's principle and its application. Problems 01 HRS

Factors affecting genetic equilibrium - Mutation, Selection, Migration, and genetic drift - Founder Principle, Inbreeding, Fitness **02 HRS**

Speciation: Modes, Reproductive isolating mechanisms **02 HRS**

Evolution at molecular level - Amino acid sequence **01 HRS**

**Behavioural Genetics: 01 HR**

Genetic basis of behavior: Introduction, approaches to genetic analysis of behavioural traits (twin studies, association studies, linkage analysis)

Nurturing behavior in mice, nest cleaning and courtship behavior in honeybees, Biological rhythms in *Drosophila*, song learning in finches **02 HRS**

**UNIT – III BIOMETRICAL GENETICS 11 HRS**

Quantitative characters: Concept of continuous variation in quantitative or economic characters in crop plants and animals; types of quantitative traits **03 HRS**

Quantitative inheritance: Features of polygenic traits in relation to oligogenic traits. Assumptions of polygenic inheritance.

Inheritance of kernel color in wheat, ear length in maize and skin colour in human. Transgressive inheritance. Problems **04 HRS**

Statistical tools: Mean, standard deviation, variance, correlation Components of polygenic variability: Phenotypic, genotypic and environmental variability. Additive variance, dominance variance and epistatic variance. **01 HR**

Heritability: broad and narrow sense, response to selection.

Problems relating to variance and heritability **02 HRS**

Genetic advance; Quantitative trait loci **01 HR**

**UNIT – IV IMMUNOGENETICS 07 HRS**

Immunity- Non-specific and Specific, T and B lymphocytes **01 HR**

Inherited immunodeficiency:

Eg: X- linked agammaglobulinaemia. **01 HR**

Major Histocompatibility Complex (MHC) - Class I and Class II HLA disease associations **03 HRS**

Transplantation – Different types; Graft histocompatibility; Graft rejection;

Mechanism of graft rejection – Sensitization phase and Effector phase; Graft-versus-host diseases (Bone marrow transplant and Kidney transplant) **02 HRS**

**UNIT – V CANCER GENETICS 07 HRS**

Regulation of mitotic cell cycle in eukaryotes **02 HRS**

Properties of cancer cells. Tumor suppressor's genes (Rb and p53 genes), Proto-oncogenes (myc and ras genes), viral oncogenes **04 HRS**

Chromosomal abnormalities associated with the specific malignancies – CML, APL, ALL, ANLL and CLL **01 HR**

### III B.Sc. Genetics -VI Semester PRACTICAL VII

**DURATION: 3 HOURS /UNIT**

**NO. OF UNITS: 15**

#### **1. Project Work:**

Project work to be done on a topic related to the subject and recorded as a dissertation/ Study visit of a Genetics research institute and recorded as a project report **5 UNITS**

2. Gene frequency problems **4 UNITS**

3. Biometrical Problems:

Quantitative inheritance: Problems on kernel color in wheat, ear length in maize, body size in poultry & rabbits.

Genetic problems on polygenic variability

Genetic problems on heritability, genetic advance and correlation **4 UNITS**

Practical tests/repetition **2 UNITS**

**Note:** 13 Practical + 2 units for practical tests/repetition

#### **REFERENCES:**

1. DROSOPHILA: GENETICS MEETS BEHAVIOR  
[www.ncbi.nlm.nih.gov/pubmed/11715043](http://www.ncbi.nlm.nih.gov/pubmed/11715043)
2. ELEMENTS OF PLANT BREEDING, Phundhan Singh (2001), 2<sup>nd</sup> edition, Kalyani Publishers, New Delhi.
3. EVOLUTION, Strickberger M.W. (1990), Jones and Bartlett, Boston.
4. EVOLUTIONARY GENETICS, Smith Maynard J. (1989), Oxford University Press.
5. GENES IN POPULATION, Spiess E. (1989), 2<sup>nd</sup> edition, Wiley-Liss, New York.
6. EVOLUTIONARY BIOLOGY, Futuyma D. (1997), 3<sup>rd</sup> edition, Sinauer Associates, Sunderland.
7. GENETICS AND ANALYSIS OF QUANTITATIVE TRAITS, Lynch M. & Walsh B. (1997), Sinauer Associates, Sunderland.
8. INTRODUCTION TO QUANTITATIVE GENETICS, Falconer D. (1995), 4<sup>th</sup> edition, Longman, London.
9. NATURAL SELECTION DOMAINS, LEVELS AND CHALLENGES, Williams G. (1992), Oxford University Press, New York.
10. PRINCIPLES OF GENOME ANALYSIS, Primrose S.B. (1995), Blackwell, Oxford.
11. PRINCIPLES OF GENETICS, Gardener et al, (1991), 3<sup>rd</sup> edition, John Wiley & Sons Publications, New York.
12. THE CAUSES OF MOLECULAR EVOLUTION, Gillespie J. (1994), Oxford University Press, New York.